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SIMULATION OF PDC2017 ASTEROID ENTRY, WATER IMPACT, HAZARD AND CONSEQUENCES ON JAPAN'S EAST AND WEST COASTS

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ABSTRACT

A hypothetical asteroid-impact scenario (http://neo.jpl.nasa.gov/pdc17/) will be used as the basis for discussion and analyses during the PDC 2017 table-top exercise. The asteroid is "discovered" on March 6, 2017, and is classified as a potentially hazardous asteroid with a diameter initially estimated between 100-250 meters. The large size uncertainty is due to uncertainties in both albedo and absolute-magnitude values. As the object is tracked over subsequent months, its impact-risk region is estimated to be 1.25 Earth diameters, wrapping more than halfway around the globe from the North Atlantic Ocean to the Pacific Ocean. Roughly 45% of the corridor is over water while the other 55% is over land. Given the significant water-impact probability, and because most of the potentially affected coastal regions are heavily

populated, we focused our simulation efforts on modeling water impacts at several locations along the asteroid risk corridor: off the north coast of Ireland (Ireland, Iceland, Spain, France) the North Sea (UK, Holland, Germany & Sweden), the Baltic Sea (Germany, Poland, Sweden, Finland and Estonia), the Yellow Sea (Korean peninsula), the sea of Japan (Japan west coast), Katakai Canyon (Japan east coast), and the Pacific Ocean (2600 km off Hawaii). We have simulated the problem from asteroid entry, to ocean impact, to wave generation, propagation, and interaction with the shoreline. The interaction of the asteroid with the ocean are simulated using the hydrocode GEODYN, creating a wave source for the Boussinesq-based water-wave-propagation code, WWP. The GEODYN-WWP coupling is based on the structured adaptive mesh refinement infrastructure, SAMRAI, and has been used to model a range of scenarios for FEMA table-top exercises conducted in 2013, 2014, and 2016, as well as for PDC 2015 and AGU 2016. Results from the wave-propagation simulations can be used to estimate onshore effects or can inform more sophisticated inundation models. In particular, we describe results of this methodology to asteroid impacts off the east and west coasts of Japan and in the Pacific Ocean. For the PDC 2017 exercise, because the size of the asteroid is not precisely known, we explore the effect of asteroid size on the landfall waves at several shoreline cities of interest near the potential impact area.

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Comments:

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